Platelet rich fibrin - The rescuer after evanescence of mineral trioxide aggregate placed in an immature tooth with a periapical lesion

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Abstract
The absence of a natural apical constriction in a nonvital young permanent tooth makes endodontic treatment a challenge. Mineral trioxide aggregate (MTA) is the material of choice for apical barrier techniques. This paper reports a case of the immature permanent maxillary left central incisor, which presented pulp necrosis secondary to dental trauma and was treated by apicification with white MTA apical plugging followed by conventional root canal therapy. The operative procedures are described, and the technique is discussed. As purulent exudate was observed from the root canal, calcium hydroxide intracanal medicament was placed for a week, followed by MTA apicification at a later date. After 2 days, on clinical examination, hard resistance was not felt and radiographic examination revealed that MTA was missing. The acidic pH and increased protein content of the periapical lesion might have resulted in the acidic dissolution of MTA. So for effective management, in the present case report one step apicification using MTA as an apical barrier and autologous platelet rich fibrin as an internal matrix was done which resulted in better healing.

Keywords
Apexification, mineral trioxide aggregate, open apex, platelet rich fibrin

Introduction
When teeth with incomplete root formation suffer pulp necrosis due to trauma, the root development ceases and apical closure cannot be achieved. Root canal treatment at this time is a significant challenge, because of the size of the canal, the thin and fragile dentine walls and the large open apex. Apexification is indicated in such scenario and mineral trioxide aggregate (MTA) is a widely used material. MTA by releasing calcium and phosphorus ion helps in the formation of cementum and osteoid-like tissue. This phenomenon is responsible for its biocompatibility, hard-tissue induction potential and sealing ability, features that make MTA a suitable material for use as an apical plug in teeth with open apices.

However, placement of MTA in contact with existing inflamed tissue may expose it to acidic environment and compromise its retention and physicomechanical properties. Here is the case report which discusses this aspect and the effective management of the present case with the use of platelet rich fibrin (PRF). PRF contains growth factors including transforming growth factor beta, vascular endothelial growth factor, and platelet-derived growth factor. PRF stimulates osteoblasts, gingival fibroblasts, and periodontal ligament cells proliferation as a mitogen.

Description of Procedure
A 17-year-old female patient presented with a chief complaint of discolouration of the maxillary left central incisor. The patient experienced intermittent spontaneous pain, mild in intensity for several months and revealed history of trauma approximately 10 years earlier, involving a direct impact on maxillary anterior teeth.

Clinical examination revealed tooth 21 with discolouration and a draining sinus tract on the labial vestibule. Thermal and electrical pulp testing with cold test (Endo-Frost, Roeko, Langenau, Germany) and electric pulp tester (Parkell, Edgewood NY, USA), respectively, elicited a negative response.

The sinus tract was traced using a gutta-percha cone into the lesion. Radiographic examination revealed that tooth 21 had an open apex associated with large periapical radiolucency, confirming the diagnosis of an immature tooth with a symptomatic chronic periapical abscess.
After rubber dam isolation, an access cavity was prepared, and the necrotic pulpal tissue remnants were removed using H-files. Minimal root canal preparation was done with a no. 80 k file using gentle circumferential filing motion. The root canal was irrigated copiously with 3% sodium hypochlorite for 10 min followed by sterile saline. Calcium hydroxide was mixed with 2% chlorhexidine gluconate to form a paste and placed in the canal, then temporarily restored with intermediate restorative material.

The patient discontinued the treatment but later reported after 9 months. Upon removal of temporary restoration, discharge of purulent exudate was observed. The root canal was irrigated with 3% sodium hypochlorite for 10 min followed by sterile saline. Calcium hydroxide intracanal medicament was placed in the canal. After a week, as root canal was free of purulent exudate, MTA apexification was planned. MTA was introduced into apical 3 mm of the root canal and a radiograph was made to evaluate the quality which was found to be satisfactory [Figure 2]. A wet cotton pellet was placed in the pulp chamber, and the tooth was temporarily restored.

2 days later, hand plugger was used to evaluate the setting of MTA. When hard resistance was not felt, the radiographic examination was done which revealed that apical plug of MTA was missing [Figure 3].

Therefore, placement of PRF as an apical barrier was planned. PRF membrane was prepared using the procedure described by Dohan et al.[4] and was gently compacted using hand pluggers to form an apical barrier. MTA was placed against the PRF matrix, and access cavity was sealed with temporary cement.

After a week the patient was asymptomatic, and a hand plugger was gently tapped against the MTA barrier to confirm the setting of MTA. The remaining portion of the canal was obturated using injectable thermoplasticized gutta-percha (Obtura III Spartan, Fenton, Missouri, USA) and zinc oxide eugenol sealer.

As the patient was not willing for a full veneer crown, nonvital bleaching was planned as a conservative treatment option. Access cavity was restored with composite Filtek Z 250XT at a later date.

The patient was recalled at 6 months postoperatively and a periapical radiograph was made which showed complete resolution of periapical radiolucency [Figure 4].

**Discussion**

MTA is a miracle material from the endodontic point of view.[5] Once it is set, MTA is considered to be a non-resorbable material. But in this case, dissolution of MTA was observed, which might have happened before its setting. This might be due to low pH and increased protein content of the periapical lesion which was evident from purulent discharge.

The physical and chemical properties of MTA material may change in the presence of an acidic pH. In fact, studies have revealed that the sealing ability, push-out bond strength and surface hardness of MTA decrease significantly in acidic environments. MTA material releases heavy metal ions including arsenic, lead and chromium in water and tissue fluids, a phenomenon that increases in acidic environments.[6]
Although the precise mechanisms are unclear, it appears that the proteins in periapical lesion interfere with the setting reaction of MTA. Proteins might act as a foaming agent and increase the total number of artificial air pores decreasing the strength of MTA. Jasiczak and Zielinski reported that cement mixed with protein resulted in a significant lengthening of the setting time.\(^7\)

Using a matrix will restrict the obturation material at the apex and prevent the extrusion of material into the periodontal tissues. PRF is an immune platelet concentrate, which has been used as a matrix, accumulating all the constituents of a blood sample conducive to healing and immunity on a single fibrin membrane.\(^8\)

Recently, novel MTA supplied with an anti-washout gel (MTA Plus) and Fast-setting pozzolan cement (Endocem) were developed which are more resistant to washout.\(^9\) Application of these novel materials in cases with periapical lesions might be an alternative treatment modality.\(^{10,11}\)

**Conclusion**

In this case, PRF might have acted as a physical barrier separating the MTA from the periapical acidic pH. The combination of PRF and MTA as an apical barrier can be regarded as a good option.